Forest Research Note

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YELLOW BIRCH GROWS BETTER IN MIXED-WOOD STANDS THAN IN NORTHERN HARDWOOD OLD-GROWTH STANDS

Yellow birch, the most valuable timber tree in the northern hardwood forest, is losing ground in northern New England. Birch dieback in the late 1930s and 1940s killed millions of board-feet of yellow birch. Meanwhile, the demand for yellow birch veneer and lumber has increased by leaps and bounds. So industries that depend upon yellow birch are having increasing difficulties in finding adequate supplies of raw material.

The prospects for a better supply situation in New England during the next few decades are not good. Practically all tracts of any size that once had good stands of yellow birch have been cut over. Future supplies must come mainly from trees that came in after logging or trees that were too small to cut when the tract was logged, and thus will be much affected by yellow birch growth rates in second-growth and cutover old-growth stands. Knowledge of the sites and conditions where yellow birch grows best would enable us to favor the species on those sites and, to some degree, improve the supply situation in the future.

Records from permanent cruise plots, which were laid out on the Bartlett Experimental Forest in New Hampshire soon after its establishment in 1931, provide comparative performance data for yellow birch on sites occupied by typical northern hardwood and by mixed hardwood-softwood stands. Records on growth and mortality from plots in these two stand types over an 8-year period after the initial cruise are summarized in this report. For the purposes of this study, only those early 8-year records were suitable because many of the mixed-wood plots were not retallied after 1939-40.

Historical

The study plots were all in old-growth stands. These stands had been cut over in the 1880s and 1890s—many of them twice, first for softwoods and, a little later, for the better hardwoods—but they had never been clear-cut. As far as we know, cuttings in the different forest types were all at about the same intensity.

Possibly the mixed hardwood-softwood stands were cut somewhat heavier than the true northern hardwoods because of the demand for softwoods at that time. However, since we have no definite knowledge of comparative intensities of cuttings, it is assumed that post-cutting conditions on the mixed-wood and northern hardwood sites were roughly similar, and that the cuttings did not affect the residual birches much differently on one class of site than the other.

In general, the stands left after the cuttings consisted of large trees that either were defective or of low-value species, together with many stems of varying quality in the pole and small sawtimber sizes. And, in general, no management practices were applied. The residual stands where the plots for this study were located remained unmanaged up to and through the 8-year period on which this report is based.

The Study

Fifteen permanent 1/4-acre cruise plots in unmanaged mixed-wood stands, and 50 such plots in unmanaged northern hardwood stands provided the basic data for this study. The mixed-wood sites were moist areas along brooks or in swales; northern hardwood sites were mostly well-drained slopes and ridges. Trees on the plots were measured at the time of establishment in 1931 or 1932, and remeasured 8 years later.

At the beginning of the study, average basal area of the mixed-wood stands was 127 square feet per acre, of which about half was in eastern hemlock and red spruce, and half in red maple, yellow birch, beech, and

Table 1.--Initial percentage of basal area in yellow birch by cover type

Cover type	Initial proportion of yellow birch	Percentage distribution of yellow birch basal area				Initial total basal area per acre
		5-10%	11-15%	16-20%	21+%	
	Percent		Percent			Square feet
Northern hardwood	17	48	27	14	11	104
Mixed-wood	17	31	29	27	13	127

other hardwoods. Average basal area of the northern hardwood stands was 104 square feet per acre, nearly all of which was in hardwoods; only a few scattered hemlocks and spruces grew on the plots. In both types, yellow birch comprised 17 percent of the basal area, and distributions of the birch by size groups fell into somewhat similar patterns (table 1). The higher percentages of the basal area in larger trees in the mixed-wood reflects faster growth rates of the birch on those sites.

Table 2.--Annual accretion[1] and mortality, in percentage of basal area, by species and type (trees larger than 4.5 inches d.b.h.)

Cover type	Beech		Yellow birch		Red maple		Eastern hemlock	
	Accretion	Mortality	Accretion	Mortality	Accretion	Mortality	Accretion	Mortality
Northern hardwood	2.1	0.6	1.7	1.3	2.6	0.1	2.6	0.1
Mixed-wood	1.6	.6	2.1	.5	2.1	.5	1.7	.1

[1]Accretion is growth in basal area (expressed here as a percentage of initial basal area) on trees that were larger than 4.5 inches d.b.h. at the time of the first measurement. Growth on trees that died during the period is not included.

Comparisons of the 8-year growth between species and types are expressed below in terms of accretion rates (see table 2). Since yellow birch always shows relatively little ingrowth because of its intermediate tolerance, accretion—which does not include ingrowth—was considered the best measure for comparing this species with its more tolerant neighbors.

The annual accretion rate of yellow birch over the 8-year period was 2.1 percent in the mixed-wood, as compared to 1.7 percent in the northern hardwood type. On mixed-wood sites, yellow birch grew as fast or faster than three common associates—beech, red maple, and eastern hemlock. On northern hardwood sites, it ranked last among these associates, partly because it grew more slowly there, and partly because the other species grew better on these sites (table 2).

Average annual yellow birch mortality, in percent of basal area, was only 0.5 percent on the mixed-wood sites; on the northern hardwood sites, it was 1.3 percent—more than 2½ times as much. In general, birch mortality compared favorably with that of other species on mixed-wood sites, but considerably exceeded that of other species on northern hardwood sites (table 2).

Discussion

Since this study was restricted to one small locality, conclusions drawn from it must be somewhat tentative. The data definitely do indicate, however, that in old-growth stands yellow birch grows appreciably faster, and suffers appreciably less mortality, on sites occupied by mixed-woods than on those occupied by true northern hardwoods.

There is abundant evidence from other Bartlett studies[1] that yellow birch in northern hardwood stands grows comparatively slowly—in fact, that it generally is the slowest growing component of such stands on typical northern hardwood sites. So far as can be determined from our data, better performance by the birch on mixed-wood sites holds true for trees of all sizes beyond the sapling stages. And although we do not have direct supporting evidence, it may reasonably be assumed to hold true for trees of all ages, and for second growth as well as old growth.

The better performance of yellow birch in mixed-wood than in northern hardwood stands is viewed primarily as an effect of site, although associated species possibly exert some influence. The specific factors responsible for the differences in growth and mortality have not been determined; this is a subject meriting further study.

The results reported above have practical significance: Because of the dwindling supply of yellow birch timber, some real effort will be required to provide for the future demands of industry. So, although northern hardwood stands have been a major source of yellow birch timber in the past, the slow growth and high mortality of the species on typical northern hardwood sites means that these sites are not the best ones for growing birch under management. Our findings indicate that one opportunity for increasing production of yellow birch lies in management practices that favor the species on the moist mixed-wood sites where it apparently grows best.

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[1]Filip, Stanley M., Marquis, David A., and Leak, William B. Development of old-growth northern hardwoods on the Bartlett Experimental Forest—a 22 year record. Northeast. Forest Expt. Sta., Sta. Paper 135. 7 pp., illus. 1960.

Gilbert, Adrian M., Wilson, Robert W., Jr., and Hutnik, Russell J. Growth behavior of northern hardwoods after a partial cutting. Jour. Forestry 53: 488-492, 1955.

Wilson, Robert W., Jr. How second-growth northern hardwoods develop after thinning. Northeast. Forest Expt. Sta., Sta. Paper 62. 12 pp., illus. 1953.